BRIM-T6

USER'S GUIDE

CABLETRON SYSTEMS

The Complete Networking Solution™

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Order Number: 9031288 September 1995

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CHAPTER 1

INTRODUCTION

Welcome to the *BRIM-T6 USER'S GUIDE*. This manual describes BRIM-T6 features, installation instructions, and operating procedures. It is intended for all users of the BRIM-T6.

1.1 USING THIS MANUAL

If you are unfamiliar with Cabletron Systems' networking products, please read this manual completely to gain an understanding of the features and capabilities of the BRIM-T6. Also, you should have a general knowledge of Token Ring (IEEE 802.5) data communications networks and their physical layer components before operating the BRIM-T6.

This manual is organized as follows:

Chapter 1, **Introduction**, outlines the contents of this manual and discusses BRIM-T6 features, capabilities, and specifications. It also describes how to get technical help and lists related documentation.

Chapter 2, **Installation**, describes how to configure and install the BRIM-T6 and Token Ring Port Interface Modules (TPIMs).

Chapter 3, **Connecting to the Network**, describes how to establish the physical link to a Local Area Network (LAN) by connecting standard network cable segments to the BRIM-T6.

Chapter 4, **Monitoring and Troubleshooting**, describes how to use the LANVIEW LEDs diagnostic system to monitor the BRIM-T6's operational status. It also describes procedures for resolving problems encountered establishing a link to a network via the BRIM-T6 interface.

Appendix A, **TPIM Specifications**, describes specifications for Cabletron Systems' series of attachable TPIMs.

Appendix B, **Media Specifications**, describes specifications for network media.

1.2 INTRODUCING THE BRIM-T6

The BRIM-T6 (see Figure 1-1) is a SNMP-manageable daughterboard that provides a bridging and routing interface for a variety of Cabletron Systems' Intel i960-based intelligent Token Ring and Ethernet host devices (for example, the MicroMMAC-T concentrator and the EMM-E6 management module).

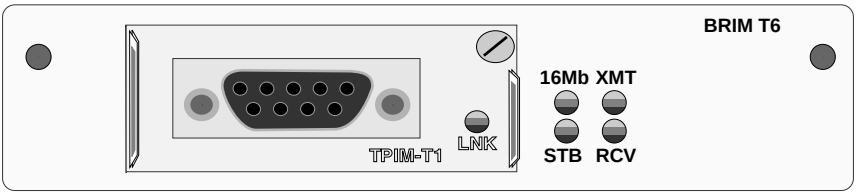


Figure 1-1. BRIM-T6

***NOTE**: Contact your Cabletron Representative for up-to-date information about products that support the BRIM-T6.*

Media Flexibility

Used in conjunction with Cabletron Systems' series of hot swappable TPIMs, the BRIM-T6 can be configured for connection to all standard network media. See Section 2.4 for instructions on how to configure and install TPIMs. Table 1-1 lists TPIMs and their corresponding media and connector types.

Table 1-1. TPIMs and Corresponding Media

TPIM	Corresponding Media	Connector
TPIM-T1	Shielded Twisted Pair	DB9
TPIM-T2	Unshielded Twisted Pair	RJ45
TPIM-T4	Shielded Twisted Pair	RJ45
TPIM-F2	Multimode Fiber Optic	ST
TPIM-F3	Single-mode Fiber Optic	ST

Jumper Selectable Ring Speed

The BRIM-T6 has a ring speed selection jumper on its component board that you can use to select operating ring speeds of either 4 or 16 megabits per second (4 or 16 Mbps). See Section 2.3 for instructions on setting the ring speed for the BRIM-T6.

Bridge/Routing Protocols

The BRIM-T6 provides Source Routing Transparent (SRT) bridging between any of the channels or ports in its host MIM or hub and the Token Ring. BRIM-T6 routing is determined by the routing protocols supported by the firmware of the host device.

Spanning Tree Algorithm (STA) Compliance

The BRIM-T6 operates in compliance with the functional specifications of the 802.1d STA, which is included in the firmware of the host device in which the BRIM-T6 is installed. The STA is used to manage primary and backup bridges and to maintain the reliability of the multi-bridged internetwork by detecting and preventing potential data loops.

BRIM-T6 Management

The host device in which the BRIM-T6 is installed provides Local Management (LM) applications for administering BRIM-T6 bridge/routing functions. The operation of the BRIM-T6 can also be managed by remote SNMP applications such as Remote LANVIEW and SPECTRUM. See the documentation included with the host device or remote management application for information on how to administer bridge/routing functions.

LANVIEW LEDs

The LANVIEW LEDs on the front panel of the BRIM-T6, together with the LED on an installed TPIM, provide an at-a-glance means of monitoring the operational status of the BRIM-T6. LEDs indicate, for example, network connection status, data transmission activity, and ring speed operation. See Chapter 4 for more information about LEDs.

1.3 BRIM SPECIFICATIONS

Environment

Storage temperature:	- 30° to 90° C
Operating temperature:	5° to 40°C
Operating humidity:	5% to 95% non-condensing

Safety

This unit meets the safety requirements of UL 1950 (without D3 deviations), CSA C22.2 No. 950, and EN60950.

EMI

This unit meets the EMI requirements of FCC Part 15 Class A, EN55022 Class A and VCCI Class I.

EMC

This unit meets the EMC requirements of EN 50082-1 including: IEC 801-2 (ESD) levels 1 through 4, IEC 801-3 (Radiated Susceptibility) levels 1 through 4, and IEC 801-4 (EFT/B) levels 1 through 4.

***NOTE**: It is the network system vendor's responsibility to ensure that the total network system, including the BRIM-T6, meets allowed limits of conducted and radiated emissions.*

1.4 RELATED DOCUMENTATION

The following documents provide supplementary information related to the procedures and technical data in this manual.

Cabletron Documentation

Cabletron Systems' *EMM-E6 User's Guide*

Cabletron Systems' *MicroMMAC-E/MicroMMAC-T User's Guides*

Cabletron Systems' *ESXMIM User's Guide*

Cabletron Systems' *Router Services Manuals*

Cabletron Systems' *Guide to Local Area Networking*

Networking Publications

The Simple Book, An Introduction to Management of TCP/IP-based Internets, Marshall T. Rose, Prentice-Hall, Inc., 1991

Local Area Networks, Token Ring Access Method, IEEE Standard 802.5 (1989)

1.5 GETTING HELP

If you need help using the BRIM-T6 or have any questions, comments, or suggestions concerning this manual, please contact Cabletron Systems Technical Support Department:

By telephone:	(603) 332-9400 Monday-Friday; 8am - 8pm EST
By CompuServe®:	GO CTRON from any **!** prompt
By Internet mail:	support@ctron.com
By Fax:	(603) 337-7055
By BBS:	(603) 337-3750
By mail:	Cabletron Systems, Inc. P.O. Box 5005 Rochester, NH 03866-5005

CHAPTER 2

INSTALLATION

This chapter describes how to unpack, configure, and install the BRIM-T6. Because the operation of a BRIM-T6 requires a properly attached and configured Token Ring Port Interface Module (TPIM), this chapter also includes TPIM configuration and installation instructions.

CAUTION: *Observe all precautions against electrostatic discharge when handling the BRIM-T6, TPIMs, and other network devices. Electrostatic discharge can damage a device's processing components. Always wear a properly grounded anti-static wrist strap when handling network devices.*

Cabletron Systems includes an anti-static wrist strap and instructions with all hardware devices.

2.1 UNPACKING THE BRIM-T6

1. Carefully remove the BRIM-T6 from the shipping box and leave it in its non-conductive bag until ready for inspection and installation.
2. Attach the wrist strap provided with the BRIM-T6 to your wrist and to a proper ground.
3. Inspect the BRIM-T6 after removing it from the bag. If there is any damage, notify Cabletron Systems Technical Support Department (see Section 1.5).

2.2 INSTALLING THE BRIM-T6

This section describes how to install the BRIM-T6 into MIMs and standalone devices. You should have the following items:

- Anti-static wrist strap
- Two coverplate screws and two standoff, or support post, screws included with the host device
- #2 Phillips screwdriver

2.2.1 Installing the BRIM-T6 into a MIM

To install the BRIM-T6 into a Media Interface Module (MIM), refer to Figure 2-1 and Figure 2-2 and follow these steps:

1. Disconnect all cables from the MIM as necessary. Note all prior cable-to-port connections to ensure proper reconnection.
2. Remove the MIM from the MMAC and place it on its side with its board components facing up.
3. Remove the BRIM receptacle coverplate from the MIM and the screws from the standoffs as shown in Figure 2-1.

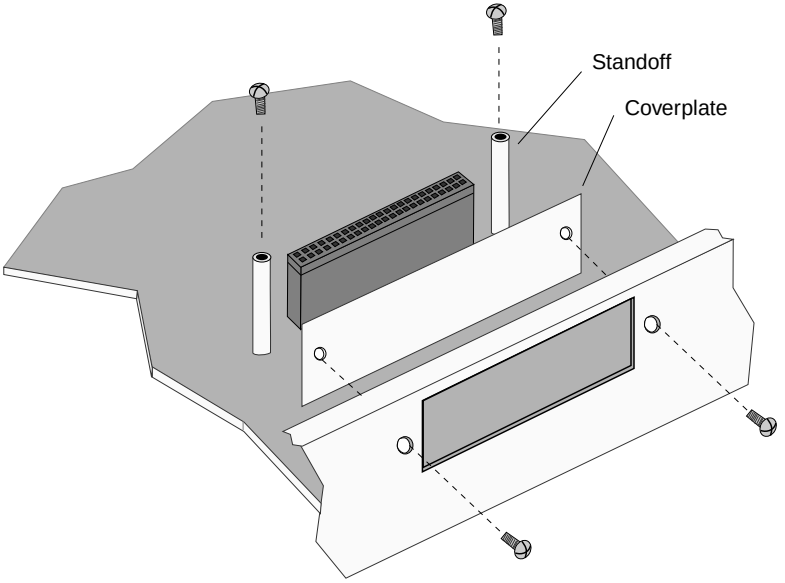


Figure 2-1. Removing the Coverplate and the Standoff Screws

4. Place the BRIM behind the BRIM receptacle panel on the MIM, aligning the screw holes on the BRIM with their corresponding screw holes on the BRIM receptacle panel and on the standoffs as shown in Figure 2-2.

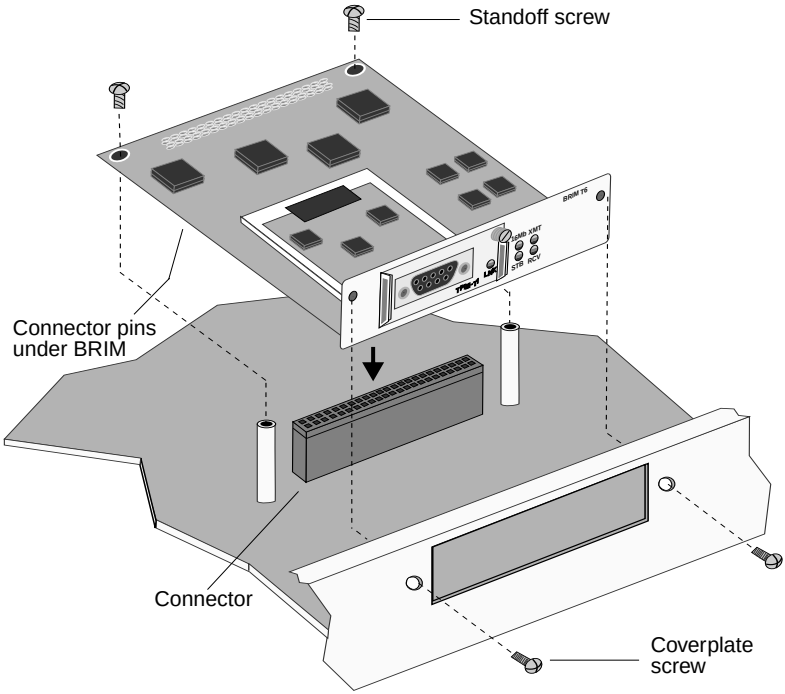


Figure 2-2. Installing the BRIM-T6

5. Insert the connector pins on the underside of the BRIM into the motherboard connector on the MIM by pressing down firmly on the rear section of the BRIM until the pins slide all the way into the connector holes.
6. Fasten the BRIM securely to the MIM motherboard with the coverplate and standoff screws.

See Section 2.4 for TPIM configuration and installation instructions.

2.2.2 Installing the BRIM-T6 into a Standalone Device

Standalone devices have the same physical setup for BRIM installation as MIMs. So you can refer to Figure 2-1 and Figure 2-2 when installing a BRIM-T6 into a standalone device.

To install a BRIM into a standalone device:

1. Power off the device and remove its chassis cover. Refer to the documentation included with the host device for instructions on removing the chassis cover.
2. Remove the BRIM receptacle coverplate and the standoff screws from the standoffs as shown in Figure 2-1.
3. Place the BRIM behind the receptacle panel, aligning the screw holes on the BRIM with their corresponding screw holes on the BRIM receptacle panel and on the standoffs as shown in Figure 2-2.
4. Insert the connector pins on the underside of the BRIM into the motherboard connector in the device. Press down firmly on the rear section of the BRIM until the pins slide all the way into the connector holes.
5. Fasten the BRIM securely to the device motherboard with the coverplate and standoff screws.
6. Reinstall the device chassis cover and then power on the device.

2.3 CONFIGURING THE BRIM-T6 RING SPEED

You must configure the BRIM-T6 ring speed to match the ring speed of the Token Ring to which it is physically linked. The BRIM-T6 ring speed setting does not, however, have to match the ring speed setting of its host device.

Also, you must reset the host device containing the BRIM-T6 after you change the BRIM-T6's ring speed for the change to take effect.

The BRIM-T6 default ring speed setting is 16 Mbps. The other available setting is 4 Mbps. To configure the ring speed, refer to the settings illustrated in Figure 2-3 and follow these steps:

1. Remove the MIM from the MMAC; if the BRIM-T6 is installed in a standalone device, remove the chassis cover from the device to provide access to the BRIM-T6's component board surface.
2. Slide the jumper down over pins 2 and 3 to select a 16 Mbps setting or over pins 1 and 2 to select a 4 Mbps setting.
3. Reset the device containing the BRIM-T6.

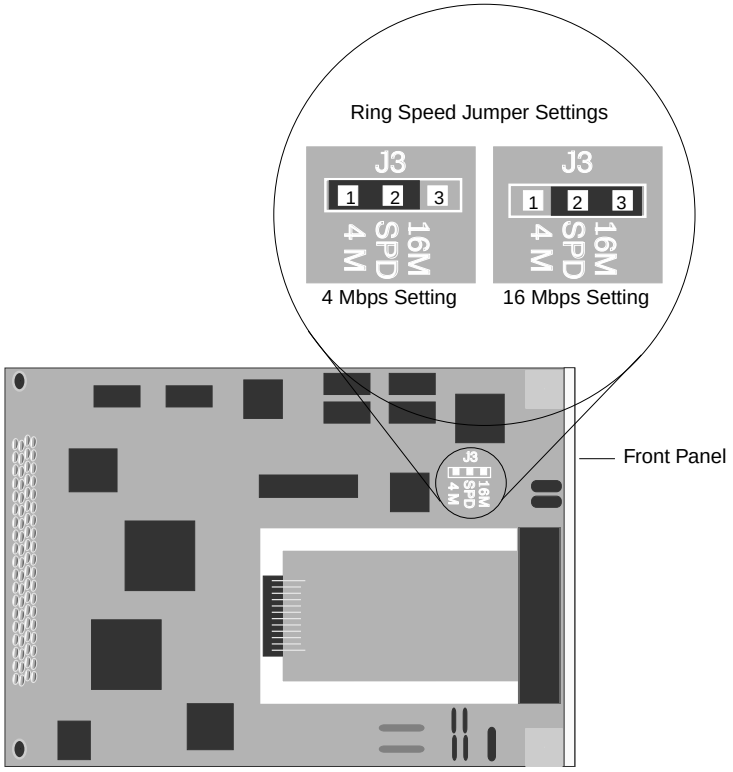


Figure 2-3. BRIM-T6 Ring Speed Settings

2.4 CONFIGURING AND INSTALLING TPIMs

This section describes how to configure TPIMs and install them into the BRIM-T6.

2.4.1 Configuring TPIMs

Cabletron TPIMs are shipped pre-configured to support Ring In/Ring Out (RI/RO) communications. For use in the BRIM-T6 as a bridge/routing interface, however, they must be reconfigured to support Station port applications. Additionally, the TPIM-F2 and TPIM-F3 must be configured to support 802.5J lobe operations via fiber optic cable.

***NOTE**: TPIM-F2 hardware version 04 and TPIM-F3 hardware version 02 or higher must be used to provide bridge links via fiber optic cable. Prior versions do not support this functionality with the BRIM-T6.*

Refer to the TPIM-F2/TPIM-F3 part number location shown in Figure 2-4 to determine functional compatibility with the BRIM-T6.

To configure TPIMs for use with the BRIM-T6, refer to Figure 2-4 and follow these steps:

1. Move the RI/RO and Station switch on the TPIMs to the Station (S or STN) position using a blunt, narrow-tipped instrument such as a screwdriver or similar instrument.
2. Move the Fiber Key to the 802.5 setting for the TPIM-F2 and TPIM-F3 using the same instrument.

   Leave the Phantom Switch setting in the default position for the TPIM-T1, TPIM-T2, and TPIM-T4.

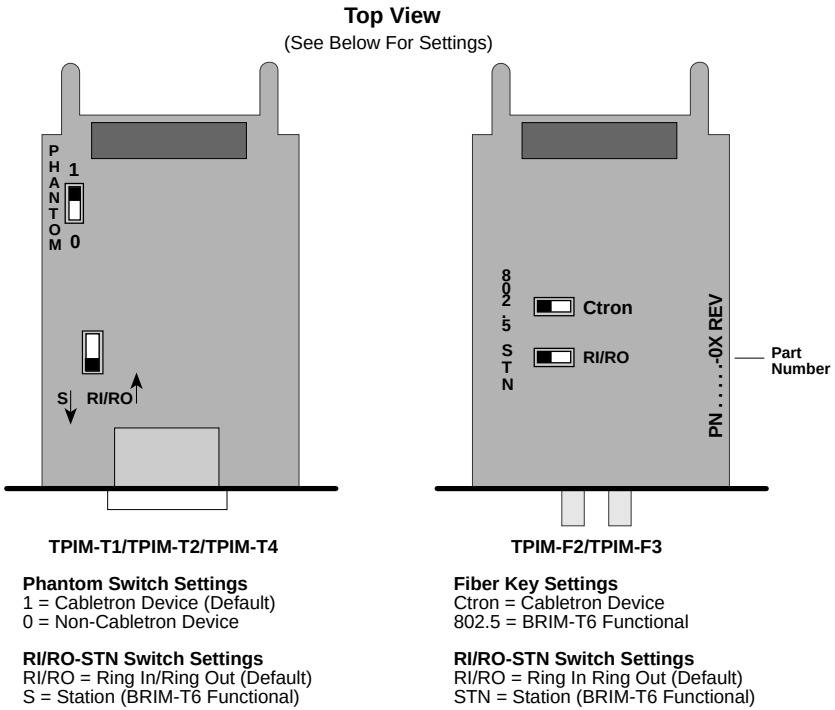


Figure 2-4. TPIM Configuration for Station Applications

***NOTE**: If the switch locations on a TPIM do not match the example locations illustrated in Figure 2-4, refer to the TPIM Reference Card included with the TPIM. The TPIM Reference Card outlines switch locations and settings. For additional help, call Cabletron Systems Technical Support Department (see Section 1.5).*

2.4.2 Installing TPIMs

To install a TPIM into the BRIM-T6, refer to Figure 2-5 and follow these steps:

1. Slide the TPIM into the TPIM slots until the connector pins in the BRIM are fully inserted into the connector on the TPIM.
2. Fasten the mounting screw to secure the TPIM in place.

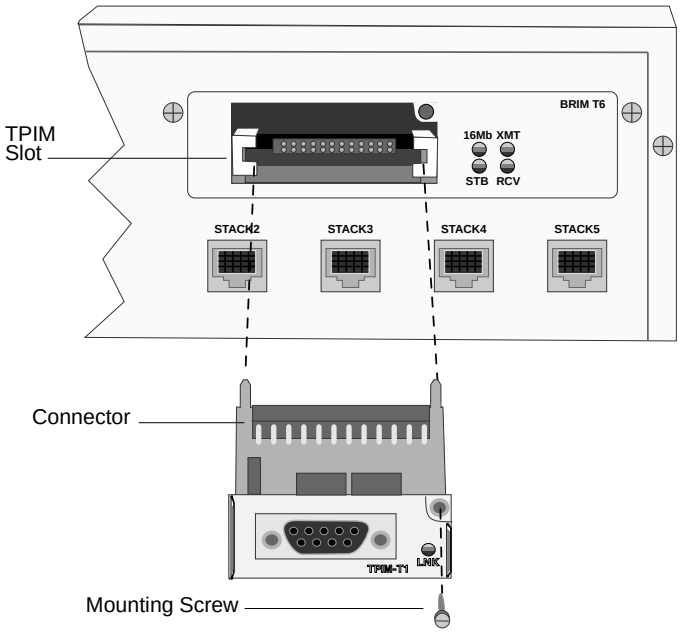


Figure 2-5. Installing a TPIM

The BRIM-T6 is now ready for operation. The next chapter describes procedures for connecting a properly configured and installed BRIM-T6 to the network.

CHAPTER 3

CONNECTING TO THE NETWORK

This chapter describes how to connect the following standard network cable types to the BRIM-T6:

- Shielded Twisted Pair (STP)
- Unshielded Twisted Pair (UTP)
- Fiber Optic

***NOTE**: Remember that the BRIM-T6 is designed and configured for connection to network concentrator Station ports only.*

3.1 CONNECTING STP SEGMENTS

Both the TPIM-T1 and the TPIM-T4 support connection to STP cable segments. The TPIM-T1 provides a DB9 interface, and the TPIM-T4 provides an RJ45 interface (see Appendix A for pinouts).

To connect an STP segment to a TPIM-T1 or a TPIM-T4, insert the DB9 or RJ45 connector into its corresponding TPIM port as shown in Figure 3-1.

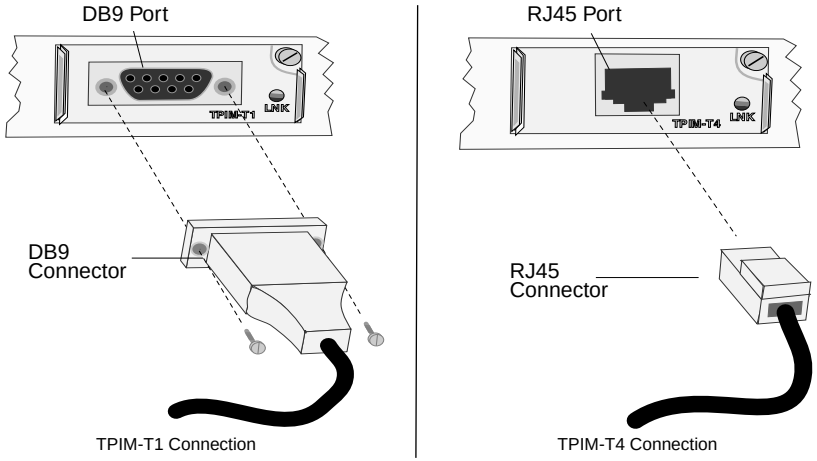


Figure 3-1. Connecting STP Segments

3.2 CONNECTING UTP SEGMENTS

The TPIM-T2 provides an RJ45 interface for connecting UTP cable segments (see Appendix A for pinouts).

To connect a UTP segment to a TPIM-T2, insert the RJ45 connector into the RJ45 port as shown in Figure 3-2.

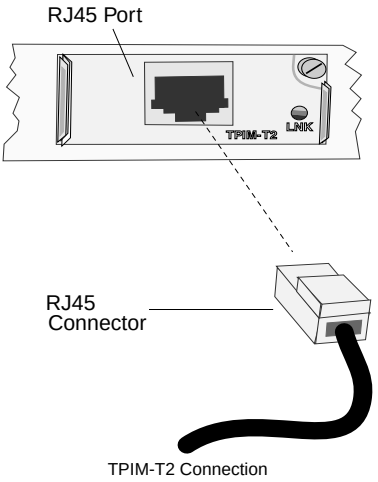


Figure 3-2. Connecting a UTP Segment

3.3 CONNECTING FIBER OPTIC SEGMENTS

Both the TPIM -F2 (for multimode) and TPIM-F3 (for single-mode) support connection to fiber optic segments. When connecting a segment to the TPIM-F2 or TPIM-F3, consider the following:

- Fiber optic segments with Straight Tip (ST) connectors attach to ST ports much like BNC connectors attach to BNC ports. The connector must be inserted into the port with the alignment key on the connector inserted into the alignment slot on the port. Then the connector must be turned to lock it down.
- The physical communication link consists of two strands of fiber optic cabling. The Transmit strand (TX) at one end connects to the Receive (RX) port at the other end and vice versa.

- Dust, dirt, and other contaminants on the ends of the connectors create data transmission problems. Avoid touching the ends of the connectors. If the ends become dirty, clean them with alcohol using a soft, clean, lint-free cloth.

To connect a fiber optic segment to the TPIM-F2 /-F3, refer to Figure 3-3 and follow these steps:

1. Remove the protective plastic covers from the fiber optic ports on the module and from the connectors on each fiber strand.
2. Attach a fiber strand to the module's receive port (labeled **RX**) and the other fiber strand to the module's transmit port (labeled **TX**).

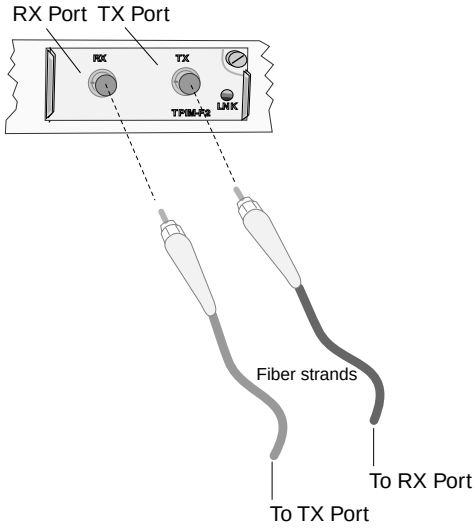


Figure 3-3. Connecting Fiber Optic Segments

3. Attach the other end of the strand that is connected to the host RX port to the destination device's TX port and attach the other end of the strand connected to host TX port to the destination device's RX port.

The next chapter describes how to use LANVIEW LEDs to monitor the operation of the BRIM-T6 and troubleshooting procedures.

CHAPTER 4

MONITORING AND TROUBLESHOOTING

This chapter describes how to use the LANVIEW LED system to monitor the operation of the BRIM-T6. It also describes procedures for resolving problems you may encounter establishing a link to a network via the BRIM-T6 interface.

4.1 LANVIEW LEDS

LANVIEW LEDs are Cabletron Systems' built-in, visual diagnostic and status monitoring system. The comprehensive LANVIEW system for the BRIM-T6 consists of four LEDs (Light Emitting Diodes) on the face of the BRIM-T6 and one LED on the face of its attached TPIM (Figure 4-1).

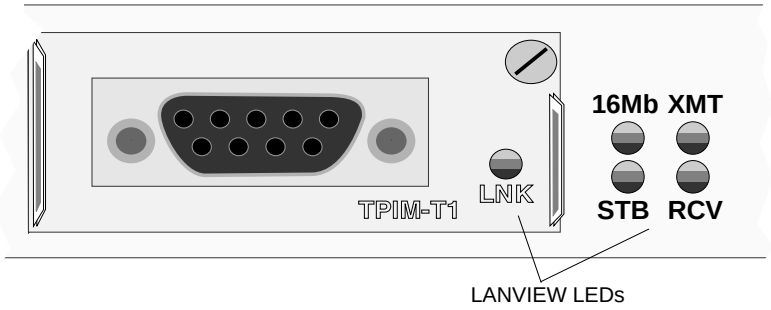


Figure 4-1. LANVIEW LEDs on the BRIM-T6 and TPIM

4.1.1 Describing BRIM-T6 LEDs

The information conveyed by each LED about the operational status of the BRIM-T6 is described as follows (also see Table 4-1 summary):

16Mb (Ring Speed)

When **solid Yellow,** 16Mb indicates that the BRIM-T6 ring speed is set to 16 Mbps. When off, it indicates that the ring speed is set to 4 Mbps.

XMT (Transmit)

When **flashing Green,** XMT indicates that the BRIM-T6 is transmitting traffic to the Token Ring network. When **solid Red**, XMT indicates that the BRIM-T6 is disabled.

When **blinking Red**, XMT indicates a speed fault condition, typically caused by a mismatch in ring speeds between the BRIM-T6 and the ring occupied by the device to which it is linked. See Section 2.3 for information about setting the correct ring speed.

RCV (Receive)

When **solid Green**, RCV indicates that the BRIM-T6 is currently enabled to receive Token Ring traffic, and when **flashing Yellow**, it indicates that it is currently receiving Token Ring traffic. When **solid Red**, RCV indicates that the BRIM-T6 is disabled by the host device.

STB (Standby)

When **solid Yellow**, STB indicates a standby condition: the BRIM-T6 is not ready or able to transmit data to the ring. Standby conditions are caused, typically, when the host device is initializing or when a TPIM is not attached to the BRIM-T6.

LNK (Media Link OK) on attached TPIM

When **solid Green**, LNK indicates that a connection exists between the BRIM-T6 and a node at the other end of the media segment. When off, (or also when **Red** on the TPIM-T1/-T2/-T4) this LED indicates either that the BRIM-T6 is not connected to another device or that the port is not receiving a signal.

Table 4-1. LED Specifications Summary

LED	Status	Description
16Mb (Ring Speed)	Solid Yellow Off	16 Mbps 4 Mbps
XMT (Transmit)	Flashing Green Solid Red Blinking Red	Transmitting Traffic Disabled Speed Fault Error
RCV (Receive)	Solid Green Flashing Yellow Solid Red	Enabled Receiving Traffic Disabled
STB (Standby)	Solid Yellow	Standby
LNK (Link)	Solid Green	Media Link OK

4.2 CHECKING THE CONNECTION

This section provides a checklist for troubleshooting network connection problems.

The LNK LED on the TPIM lights green when there is an established link between the BRIM-T6 and the device at the other end of the media connection. If, however, the LNK LED lights red or is not lighted, a link has not been established. To resolve the problem, try the following procedures:

- Check that the host device and the device at the other end of the segment have power.
- Check that the TPIM is securely installed in the BRIM-T6 and that the BRIM-T6 is securely installed in the host device.
- Check for correct connector-to-port attachments at the BRIM-T6 and the destination device.
- Inspect the cabling system (cable and connectors) for damage and replace damaged components.

- Verify that STP and UTP connectors (DB9 and RJ45) are pinned properly. For fiber, verify that the receive-to-transmit connection of strands between devices is correct.
- Check that the connection meets the dB loss limit and media specifications outlined in Appendix B.
- Check that the BRIM-T6 port is enabled through Local Management.

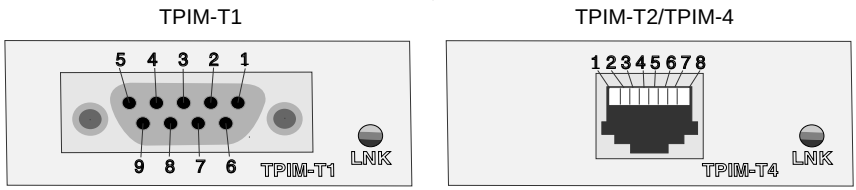
Contact Cabletron Systems Technical Support if you still cannot establish a network link.

APPENDIX A

TPIM SPECIFICATIONS

A.1 TWISTED PAIR TPIM PINOUTS: STATION MODE

Figure A-1 illustrates pinouts for TPIMs that support twisted pair cable (STP and UTP) and that are also configured to support Station applications.



1 Receive +
2 Ground
3 +5V at 250mA
4 Ground
5 Transmit -
6 Receive -
7 Ground
8 Ground
9 Transmit +

1 Not Used
2 Not Used
3 Transmit -
4 Receive +
5 Receive -
6 Transmit +
7 Ground
8 Not Used

Figure A-1. TPIM-T1/T2/T4 Pinouts for Station Mode.

A.2 FIBER OPTIC TPIM SPECIFICATIONS

The TPIM-F2 supports Multimode fiber optic cabling, and the TPIM-F3 supports Single-mode fiber optic cabling.

Table A-1 lists TPIM-F2 specifications, and Table A-2 lists TPIM-F3 specifications.

Table A-1. TPIM-F2 Performance Specifications

Parameter	Typical Value	Worst Case	Worst Case Budget	Typical Budget
Receive Sensitivity	-30.5 dBm	-28.0 dBm	—	—
Peak Input Power	-7.6 dBm	-8.2 dBm	—	—
Transmitter Power:				
50/125 µm	-13.0 dBm	-15.0 dBm	13.0 dB	17.5 dB
62.5/125 µm	-10.0 dBm	-12.0 dBm	16.0 dB	20.5 dB
100/140 µm	-7.0 dBm	-9.0 dBm	19.0 dB	23.5 dB
Bit Error Rate: Better than 10^{-10}				

The transmitter power and receive sensitivity levels given in Table A-1 and Table A-2 are Peak Power Levels after optical overshoot. A Peak Power Meter must be used to correctly compare the given values to those measured on any particular port.

Table A-2. TPIM-F3 Specifications

Parameter	Typical	Minimum	Maximum
Transmitter Peak Wave Length	1300 nm	1270 nm	1330 nm
Spectral Width	60 nm	–	100 nm
Rise Time	3.0 nsec	2.7 nsec	5.0 nsec
Fall Time	2.5 nsec	2.2 nsec	5.0 nsec
Duty Cycle	50.1%	49.6%	50.7%
Bit Error Rate: Better than 10^{-10}			

APPENDIX B

MEDIA SPECIFICATIONS AND REQUIREMENTS

This Appendix provides information about cabling media (Fiber, STP, UTP) used with the BRIM-T6.

B.1 FIBER OPTIC

Table B-1 defines total signal attenuation tolerances for both single-mode and multimode fiber cabling. Both types of cabling have a typical constant attenuation rate per km of fiber cable, and each connector on the cable system contributes significant additional attenuation. Maximum drive distances define maximum allowable cable length.

Table B-1. Signal Tolerances for Fiber Optic Cable

Cable Type	**Total Allowable Attenuation**	**Maximum Drive Distance**
Multimode		
50/125 µm	13.0 dB or less	2 km (2187.2 yards)
62.5/125 µm	16.0 dB or less	
100/140 µm	19.0 dB or less	
Typical Signal Attenuation Rate: ≤ 2.5 dB/km.		
Single-Mode		
8/125-12/125 µm	10.0 dB or less	10 km (10936.0 yards).
Typical Signal Attenuation Rate: ≤ 0.5 dB/km.		

NOTE: *The attenuation values shown include the attenuation attributable to cables, connectors, patch panels, and reflection losses due to impedance mismatches in the segment.*

B.2 SHIELDED TWISTED PAIR (STP)

STP cable categories are listed as follows:

- **IBM Type 1** consists of two STP lengths of 22 AWG solid wire for data. There are three versions of Type 1: Indoor, Outdoor, and Plenum. It is typically used for the longest cable runs within the walls of buildings.
- **IBM Type 2** is similar to Type 1 data cable, but has four additional UTP lengths of 22 AWG solid wire carried outside of the shield casing. There are two versions of Type 2: Plenum and Outdoor. It is typically used for voice communication and often used to wire cable runs within the walls of buildings.
- **IBM Type 6** consists of two STP lengths of 26 AWG stranded wire for data. Used in patch panels or to connect devices to/from wall jacks. Attenuation for Type 6 cable is 150% of Type 1 cable (e.g., 66 m of Type 6 =100 meters of Type 1).
- **IBM Type 9** is similar to Type 1, but uses 26 AWG solid wire. Attenuation for Type 9 cable is 150% of Type 1 cable (e.g., 66 m of Type 9 = 100 meters of Type 1).

Impedance and Attentuation

The attenuation values shown Table B-2 include the attenuation of the cables, connectors, patch panels, and reflection losses due to impedance mismatches in the segment.

Table B-2. STP Cable Specifications

Type	Freq.	Impedance	Attenuation
1 & 2	4 MHz 16 MHz	150Ω ± 15% 150Ω ± 15%	<22 dB/km (6.7 db/1000 ft.) <45 dB/km (13.7 db/1000 ft.)
6 & 9	4 MHz 16 MHz	150Ω ± 15% 150Ω ± 15%	<33 dB/km (10 db/1000 ft.) <66 dB/km (20 db/1000 ft.)

Maximum Lobe Length

Lobe length is the physical length of the cable connecting a station to its TCU port. Table B-3 shows maximum lobe length according to ring speed. The length figures are for total lengths of STP cable only.

Maximum Trunk Lengths

The maximum trunk cable length between active devices is equal to the maximum drive distance. When the neighboring device is passive, the Maximum Drive Distance *must not exceed* the combined length of twice the longest trunk cable plus the longest lobe cable attached to the passive ring segment (see Table B-3).

Table B-3. STP Maximum Lengths

IBM Type	Max. Lobe Length		Max. Drive Distance	
	4 Mbps	**16 Mbps**	**4 Mbps**	**16 Mbps**
1 & 2	200 meters (660 feet)	100 meters (300 feet)	770 meters (2525 feet)	346 meters (1138 feet)
6 & 9	30 meters (99 feet)	30 meters (99 feet)	513 meters (1683 feet)	230 meters (755 feet)

NOTE: *IBM Types 6 & 9 are to be used only for lobe connections from station to wall jack and patch panels.*

B.3 UNSHIELDED TWISTED PAIR (UTP)

TPIM-T2 supports voice-grade UTP cable (as described in EIA/TIA TSB 568) and IBM Type 3 cable.

WARNING*: Do not connect UTP cabling to any non-Token Ring network conductors (telephone, etc.) or ground. If in doubt, test wiring before using. Telephone battery and ringing voltages used in UTP telephone circuits may present a shock hazard and may damage Token Ring equipment when connected to token ring cabling.*

UTP consists of four pairs of 24 AWG solid wire for data or voice communication and is typically used to wire cable runs within the walls of buildings. In some installations, existing UTP building wiring can be used for Token Ring cabling. UTP cable must conform to the limits shown in Table B-4.

Better grades of UTP cable known as supergrade or level 4 are now available. These improved grades of UTP can often be used to permit operation at 16 Mbps on longer lobe cables.

Attenuation and Impedance

The attenuation values shown in Table B-4 include the attenuation of the cables, connectors, patch panels, and reflection losses due to impedance mismatches in the segment.

Table B-4. UTP Voice Grade and Category 3 Specifications

Frequency	Impedance	Attenuation
1 MHz	100Ω ±15%	<26 dB/km (8 dB/1000 ft.)
4 MHz	100Ω ±15%	<56 dB/km (16 dB/1000 ft.)
10 MHz	100Ω ±15%	<98 dB/km (30 dB/1000 ft.)
16 MHz	100Ω ±15%	<131 dB/km (40 dB/1000 ft.)

Maximum Lobe Lengths

The lobe length is the physical length of the cable connecting a station to its TCU port. Table B-5 shows maximum lobe length according to ring speed. Length figures are for total lengths of UTP cable only.

Table B-5. UTP Maximum Lobe Lengths

UTP Cable Type	Maximum Lobe Length	
	4 Mbps	**16 Mbps**
Category 3	100 meters (330 feet)	60 meters (198 feet)
Category 4	100 meters (330 feet)	60 meters (198 feet)
Category 5	130 meters (429 feet)	85 meters (280.5 feet)